Australasian Transport Research Forum 2019 Proceedings
30 September – 2 October, Canberra, Australia
Publication website: http://www.atrf.info

Parking constraints as a corridor management tool: A method for building sustainable cities

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Abstract

In modern activity centres, peak-period traffic demand along adjacent strategic corridors often exceeds the available road capacity. Traffic modelling of these constrained corridors can provide very little useful information: since substantial road capacity increases are infeasible (and largely ineffective long-term), development-led demand growth inevitably leads to projections of crippling congestion.

A road corridor can be considered from a simple supply/demand perspective, where supply is determined by local capacity constraints, and demand is related to land use (locally and at a strategic level) and private vehicle mode share. The relationship between land use and vehicle trip generation is largely defined by parking, so restricting parking in an area can be an effective way of limiting vehicle trip generation. This is the premise of the WA Department of Transport's parking cap policy.

The Integrated Model methodology described in this paper extends previous work by combining the results of parking demand modelling with a statistical understanding of the mobility function of the critical boundary road network. The model outputs are fine-grained enough to link the provision of parking to the generation of vehicle trips for each primary trip purpose.

This paper discusses the general methodology and provides a case-study example of its utility in determining parking supply and mode share requirements for future scenarios.

1 Introduction

The primary form of Australian land-use planning comprises a series of dense activity centres that create economically sustainable environments for residents, employees and visitors, surrounded by lower-density residential and commercial/industrial zones. The viability of these activity centres is inextricably linked to the provision of a variety of transport modes.

If future centres are to function effectively we must manage the needs of a complex system that includes internal land use, transport infrastructure, and the key strategic corridors that feed it. This requires a sustainable transport and land use solution that recognises the limited capacity of the road network to cater for private vehicle growth; establishes a feasible mode share target for the centre; and supports this target through parking policy and supply, public transport infrastructure, pedestrian and cycling facilities.

2 Methodology

This paper describes a methodology to estimate sustainable transport mode shares for regional through-traffic and activity centre employees, residents and visitors, using parking restrictions to limit the peak-period generation of destination traffic by trip purpose.

The results of parking demand modelling can be integrated with traffic modelling outputs to create a road capacity-based parking cap, and identify where parking demand is likely to exceed the available supply. The outputs from this Integrated Model define a “decision space” that supports a sustainable transport outcome, where peak-period vehicle trip demand is equivalent to or less than the practical road capacity.

The Integrated Model uses best-practice guidelines (ITE 2010; RTA 2002; Smith 2005) and household travel survey behaviour data (DTMR 2017a; DTMR 2017b; TfNSW 2017; TfV 2017) to disaggregate traffic along a constrained corridor into regional, resident, visitor and employee demands. It then incorporates the outputs from traditional mesoscopic corridor modelling and intersection modelling with a detailed understanding of activity centre function, to determine the potential for mode shift across each of these groups.

In this process the primary driving factor is parking supply, which is used as a restraint on residential vehicle ownership as well as visitor and employee private vehicle mode choice. The quantum of parking allocated to residents, employees and visitors effectively sets a finite limit on the vehicle trip generation for the activity centre.

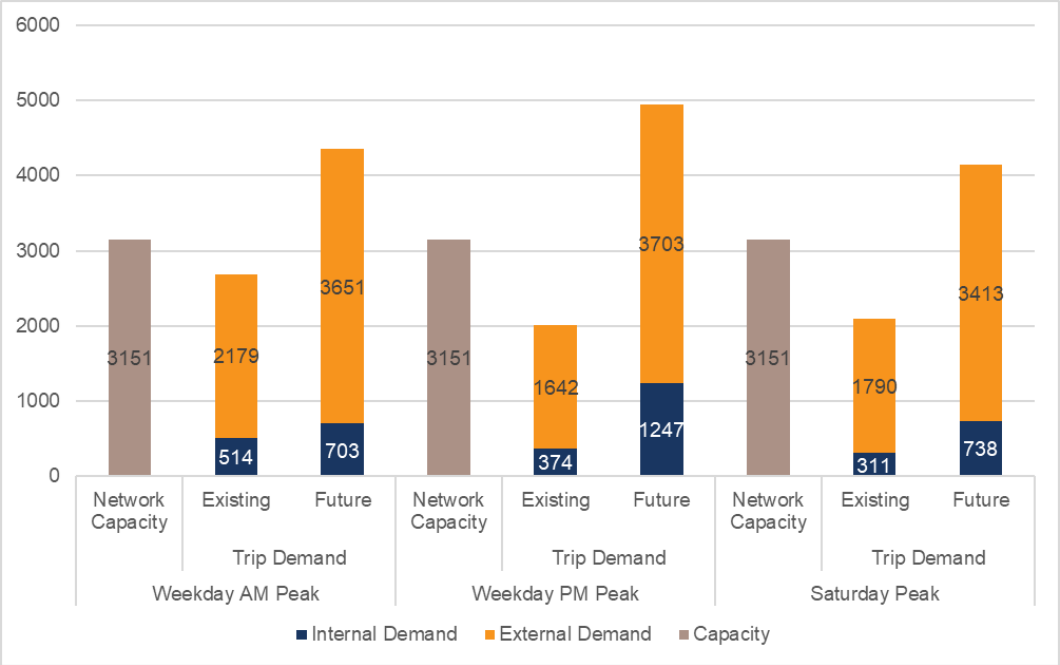
3 Case study example

The following case study explores the application of the Integrated Model methodology to the redevelopment of the West Leederville Activity Centre (WLAC). As community consultation is ongoing, specific outcomes or findings may be subject to change.

3.1 Traffic model

A mesoscopic model was constructed based on Main Roads WA ROM24 strategic modelling. A summary of the peak-hour business-as-usual vehicle trip demand along the key arterial corridor is shown below (Figure 1), and compared against the critical peak-hour network capacity constraint, as defined by peak period intersection analysis.

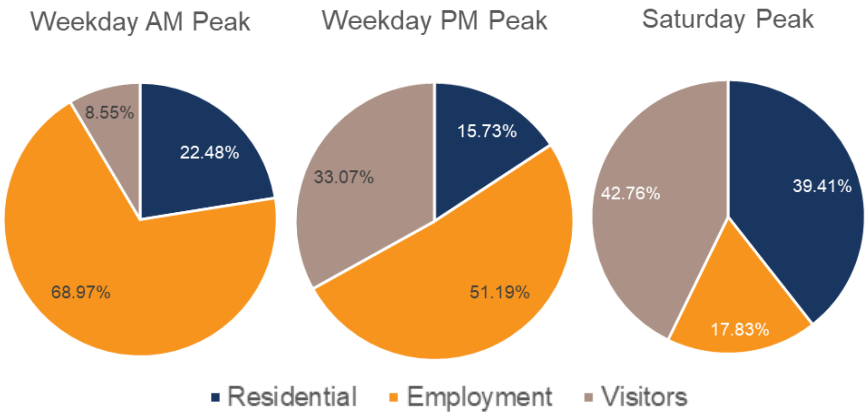
Figure 1: Peak period trip demands along Cambridge Street



3.2 Activity Centre Trip Categorisation

Household travel survey and census (ABS 2016) data was used to estimate the proportions for person-trip demand across each category, during the identified peak periods. Figure 2 shows these proportions at the full build-out of the WLAC.

Figure 2: Proportions of WLAC trips by category (full build-out)



3.3 Mode shift requirement

While transport mode shift may be induced through improved alternative transport, experience shows that this is most effective when accompanied by congestion impacts, parking supply restrictions and paid parking. Of these, parking supply is the component that can be most effectively controlled by local government at the planning stage.

This methodology uses three categories of parking: resident, employee and visitor. The particular impacts of parking supply restriction on trip behaviour are considered separately for each category. These three avenues of parking restraint are somewhat independent, and all can be enacted through the planning process.

Table 1 shows the decision space calculated by the Integrated Model, illustrating one solution set for the behaviour shift required to achieve a sustainable transport outcome in the WLAC case study area.

Table 1: Visitor mode shift required

37.5% Regional traffic displaced						
		Average residential parking supply (bays per unit)				
		0.8	1.0	1.2	1.4	1.6
Employees (journey to work mode share)	45%	-27%	-33%	-40%	-46%	-53%
	50%	-39%	-46%	-52%	-59%	-
	55%	-52%	-58%	-65%	-	-
	60%	-64%	-71%	-	-	-
	65%	-75%	-	-	-	-

3.4 Mode share

The chosen scenario can be applied to existing baseline mode shares to determine the mode shift required to achieve a sustainable transport outcome.

Table 2 shows a comparison between 2018 baseline and projected full build-out (FBO) mode shares for the scenario highlighted in Table 1 above.

Table 2: Transport mode shares by Trip Purpose (2018 to full build-out)

	Residential		Work		Shopping		Recreation	
Mode	2018	FBO	2018	FBO	2018	FBO	2018	FBO
Car as driver	61%	39%	67%	50%	62%	40%	50%	33%
Car as passenger	17%	11%	5%	5%	24%	20%	31%	26%
Public transport	12%	23%	22%	32%	5%	18%	5%	11%
Walking	7%	21%	3%	5%	9%	19%	14%	28%
Cycling	2%	6%	4%	8%	1%	3%	1%	2%

The parking ratios to achieve this outcome were determined through parking demand modelling for the WLAC land uses, and shown in Table 3.

Table 3: Maximum parking supply rates

Land use	Existing requirements (2018)	Future (full-build-out)
Multi-unit residential (average)	1.6 bays/unit	1.0 bays/unit
Off-street residential visitors	0.25 bays/unit	0.1 bays per unit
Dedicated office	3.3 bays/100sq.m	1.4 bays/100sq.m
Non-office commercial	5.0 bays/100sq.m	2.7 bays/100sq.m

4 Conclusion

Parking supply management is an essential element to the successful operation of any activity centre. The Integrated Model discussed above is an innovative method of quantifying the requirements for parking and tying this directly to the capacity of the road network.

The Integrated Model can be used to determine realistic mode shares for individual trip purposes, and to reinforce these through parking constraints and alternative transport provision. The outputs have been employed in realistic scenarios to inform a precinct parking cap, as well as to allocate this cap to land uses by need.

The mode share targets derived through the process assist in the allocation of funds to sustainable transport modes, forming the basis for green travel planning at all levels.

5 References

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